

Plum Brook Reactor Facility

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NASA Glenn Research Center Plum Brook Reactor Facility Decommissioning Overview

Rod Case - Decommissioning Project, Asst. RSO



Plum Brook Reactor Facility History

- The Plum Brook Reactor Facility (PBRF) consisted of a 60 MW main reactor, a 100 KW Mock Up reactor, seven hot cells for metallurgical analysis of irradiated material, and several support structures.
- The facility was used to perform basic research into the effects of neutron radiation on materials intended for use in the nuclear rocket programs (NERVA, ROVER)
- 1958 – Construction Begins
- 1961 – Initial Criticality
- 1963 – 1973 – Full power operations







PBRF History – Shutdown to Decommissioning

- 1973 – With the termination of the nuclear rocket program the decision was made to shut down the PBRF
- 1973 – Between January and June of this year the facility was placed in a 'Safe, Dry Storage' condition; all fuel was shipped from the site
- 1997 – NASA decided to proceed with decommissioning of the PBRF



What is Decommissioning?

- Decommissioning is the process of cleaning up a reactor site to a level that allows unrestricted release of the NRC license.
 - Contaminated and activated equipment is removed
 - Remaining building surfaces and open land areas are cleaned to below the levels specified in the Final Status Survey Plan
 - After clean up (decontamination) an extensive effort is made to survey and document that all areas are in fact clean (below the Derived Concentration Guide Lines – DCGLs)
 - NRC independently verifies the above actions are complete, then terminates the facility license.



Decommissioning End State

- The end state will be an open, green field.
 - Following license termination all structures will be demolished to 3' below grade.
 - All remaining subgrade areas filled with clean, hard fill to -3', then topped off with soil
 - No future monitoring will be required
 - The land will remain part of the buffer zone for the rest of Plum Brook Station.
- DCGLs are low enough that a family could come to live on the site as farmers and still be safe.



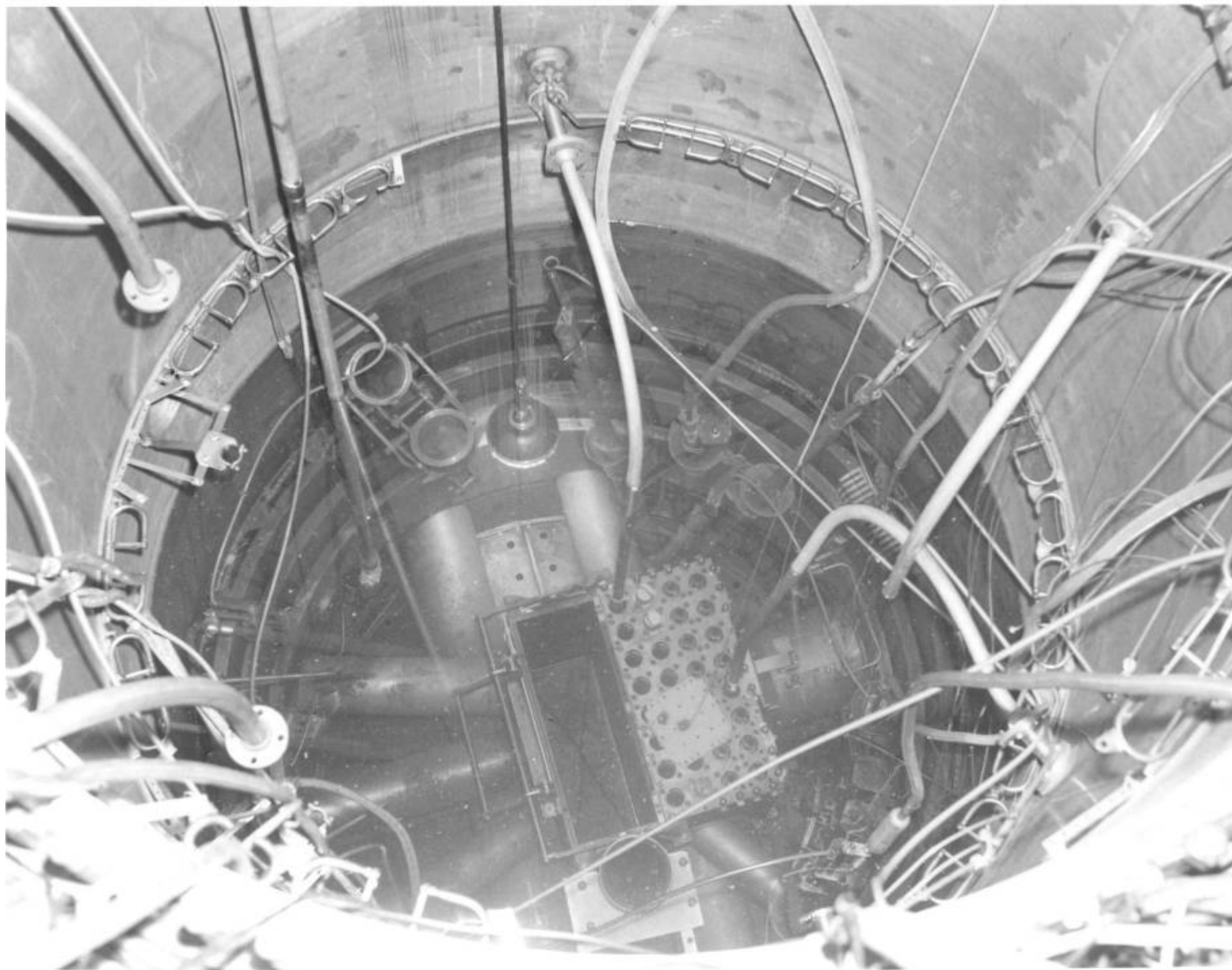
Timeline

- 1997 NASA decides to decommission
- 1999 NASA submits D-Plan to NRC, begins pre-decommissioning work
- 2002 NRC approves D-Plan, NASA begins decommissioning in full
- 2004 NASA submits Final Status Survey Plan to NRC (approved in March 2008)
- 2010 Estimate for completion of field work
- 2011 Estimate for license termination and site restoration



Where are we now?

- More than 99% of the source term has been safely removed, and all buildings are empty.
- Both reactors and control rooms are gone.
- 18 million pounds of Low Level Rad Waste have been shipped offsite for disposal
- 1.1 million pounds of metal and 0.8 million pounds of concrete have been salvaged for recycling
- Decontamination complete in nearly all structures except the Reactor Building
- Over three miles of embedded piping has been cleaned and surveyed.
- FSS completed in 40% of the building interiors





Reactor Segmentation

Late 2003



Reactor Lid



Control Rod



Shrapnel Shield



Beryllium Plate

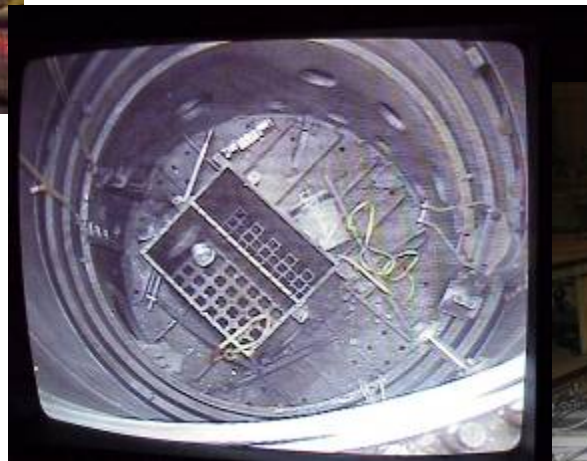


Reactor Segmentation

Early 2004



Removing core box



Inside view



Core box at cutting station



Reactor Segmentation

Spring/Summer 2004



Flow guide



Metering plate



Thermal shield



Shrapnel shield



Thermal column













Hot Lab area after
loose equipment
removal







Fixed Equipment Removal

Reactor Building



Before



During



After



Fixed Equipment Removal

Before



Service Equipment Building



After

During



Fixed Equipment Removal

Waste Handling Building



Before

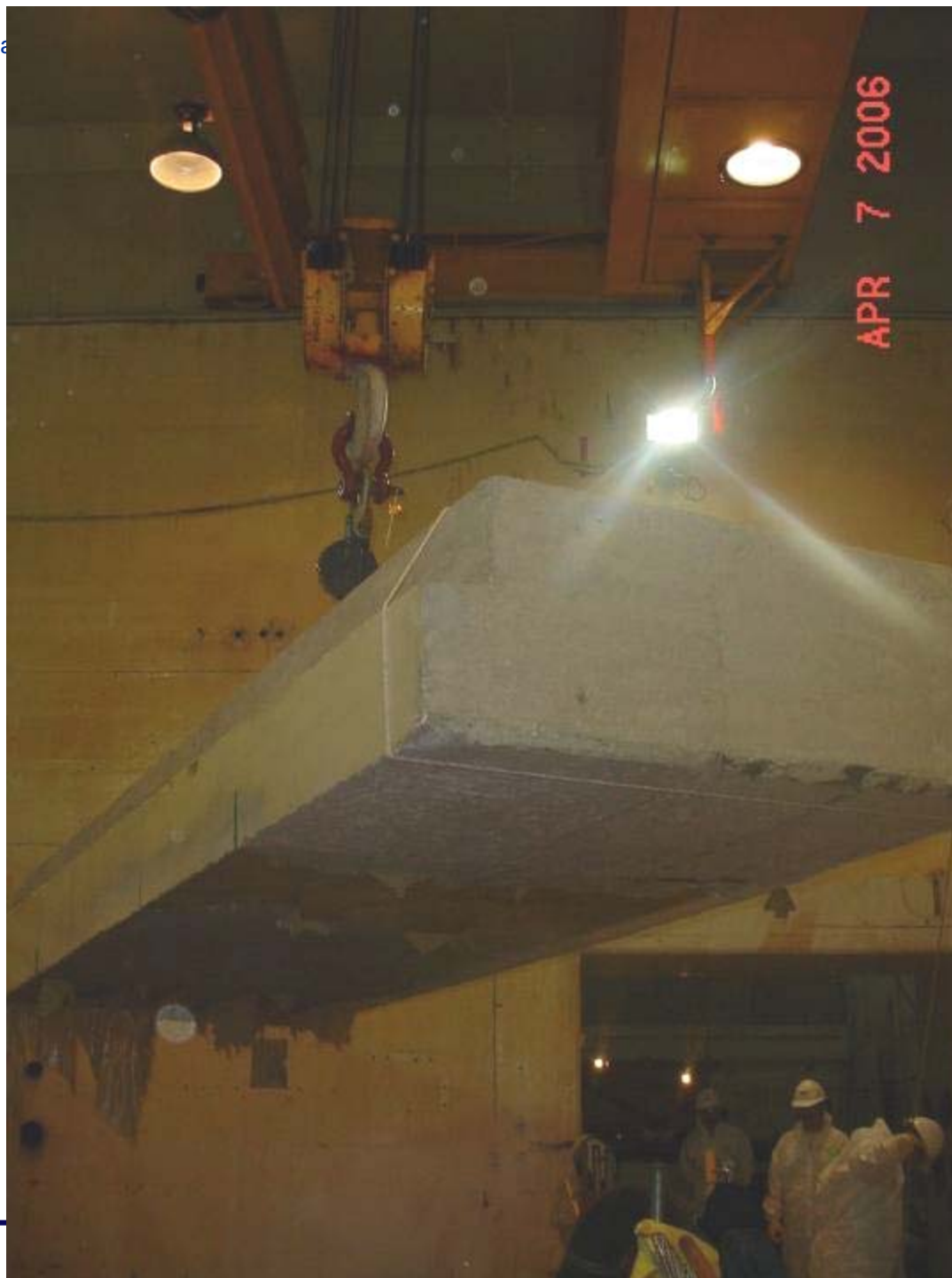


During



After











Fan House Basement - Before







Hot Pipe Tunnel - Before





Hot Pipe Tunnel Roof and wall - after





Brokk with Depth Guide



HPT Floor with 1" of
concrete removed





Sponge Jet Blaster





Unistrut – Before and After







Warm Handling Room - before



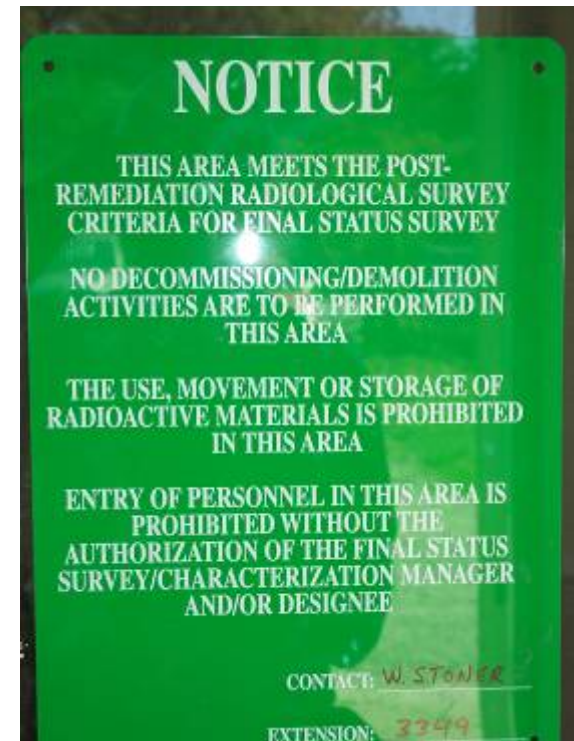






Where we are today Final Status Survey

- Final Status Survey (FSS) is the final step in decommissioning leading to license termination
- FSS is how we prove we have cleaned all remaining surfaces, structures, and open land areas to the level that is safe
- Nuclear Regulatory Commission approved our FSS Plan in March 08
- FSS field work began in the Reactor Office Laboratory Building in September 07







Off Site Contamination

- In October of 2005 Cesium-137 was discovered in the sediment of Plum Brook, an offsite stream that was part of the normal discharge path for 'clean' process water during the operating days.
- The levels were low enough that environmental monitoring performed over the years did not detect them, but once FSS sensitivity level instruments were used it was detectable.
- Background in the area for Cs-137 is about 0.5 picocuries per gram, levels we found averaged 2 to 3 picocuries per gram, though a few elevated readings in the 20 – 30 picocurie per gram range were seen.
- An immediate scoping investigation was launched to determine the scope and extent of the Cesium issue.



Off-Site Contamination (cont)

- The scoping survey confirmed the presence of low levels of Cs-137 down the length of Plum Brook
- NASA immediately notified the federal, state, and local officials, the media, and the public
- A commitment was made to thoroughly investigate the issue, and to do what was necessary to insure the safety of the public.
- The entire effort took just over 2 years. Throughout it NASA has kept all parties involved, including letters to the affected property owners with sampling results, public updates at the Community Work Group meetings, and periodic interviews with local media.



Where we are today Plum Brook

- NASA has finished its sampling efforts along Plum Brook and in Sandusky Bay
 - Characterization – determines what is there, and what level
 - Bounding – determines the physical extent of the deposit
- Based on a detailed analysis of the stream hydrology, and collecting and analyzing over 5,000 sediment samples NASA can with confidence say
 - **There is no health concern for those who live, work, or play along Plum Brook**
 - **There is no health concern for the city of Sandusky using Sandusky Bay as a source of drinking water**



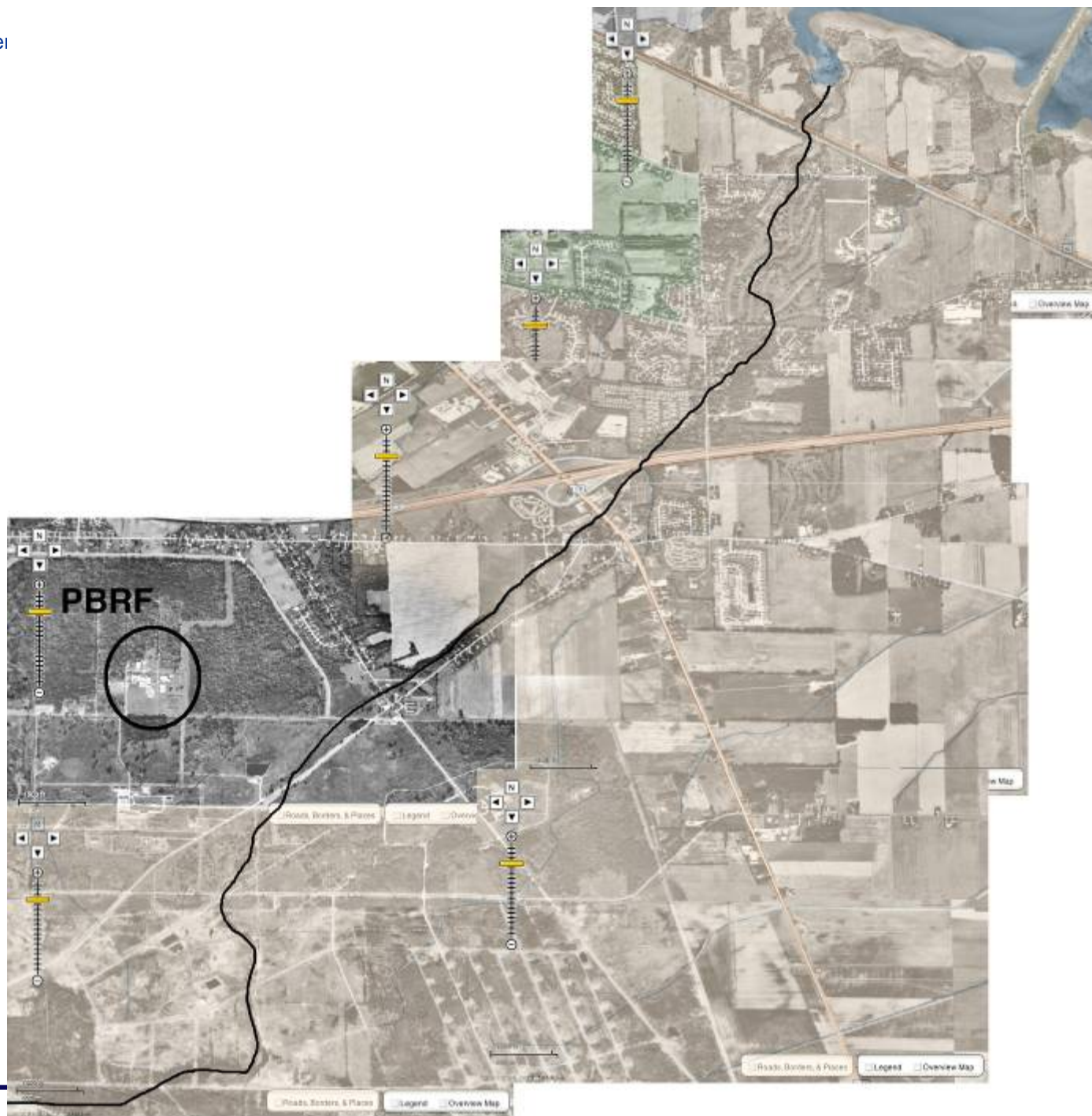
Plum Brook (cont)

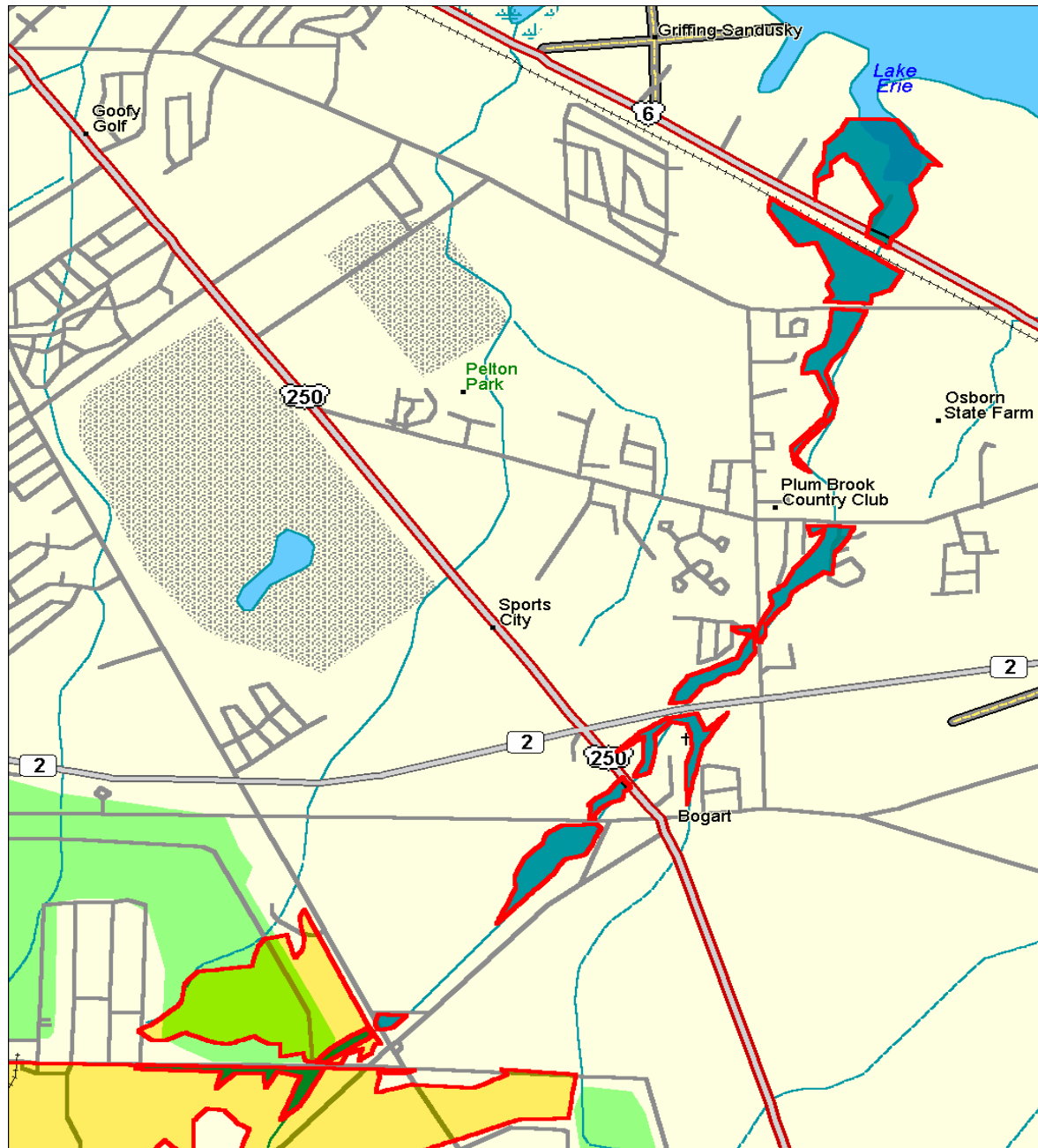
- With guidance from Haag Environmental Company, a local company with hydrogeologic expertise, we understand what happened to the cesium-137 that was discharged from the facility during operation
 - How the material moved downstream over time
 - Where it is now
- Cesium binds almost permanently with clay sediment
 - Find where the sediment moved to, you find the cesium
- Deposits, or cells, tend to be isolated, relatively small in physical size, and are often buried under several inches to several feet of clean sediment, with only the edge next to the stream exposed.



Plum Brook (cont)

- We now have a much better understanding of where the material is and how much, the hydrology, and current and projected land use for the various sections of Plum Brook
- Based on this knowledge, and at the NRC's suggestion, NASA is performing an analysis to establish the isotope specific clean up levels or Derived Concentration Guide Lines (DCGLs) that will be specific for Plum Brook and reflect actual conditions.
- NASA is committed to clean up Plum Brook using the same standard that we are applying to the reactor site. The Plum Brook specific DCGLs will ensure this is the case.





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Plum Brook Characterization and Modeling





What's next?

- Complete decontamination and remediation of remaining structures, Pentolite Ditch and Plum Brook.
- Prepare surfaces for Final Status Survey
- Complete Final Status Survey
- Terminate licenses.
- Site Restoration